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PHASE I RCRA
FACILITY INVESTIGATION REPORT

VOLUME 1 OF 3

PREPARED FOR
ALLIED-SIGNAL, INCORPORATED
FIBERS DIVISION, FRANKFORD PLANT
PHILADELPHIA, PENNSYLVANIA

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1.0 INTRODUCTION

HALLIBURTON NUS Environmental Corporation (HALLIBURTON NUS, formerly known as NUS Corporation) conducted the Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for the Allied-Signal, Incorporated, Fibers Division, Frankford Plant in Philadelphia, Pennsylvania. This report summarizes pre-RFI investigative activities and presents the results of the RFI fieldwork conducted from December 1991 through February 1992.

1.1 SITE LOCATION

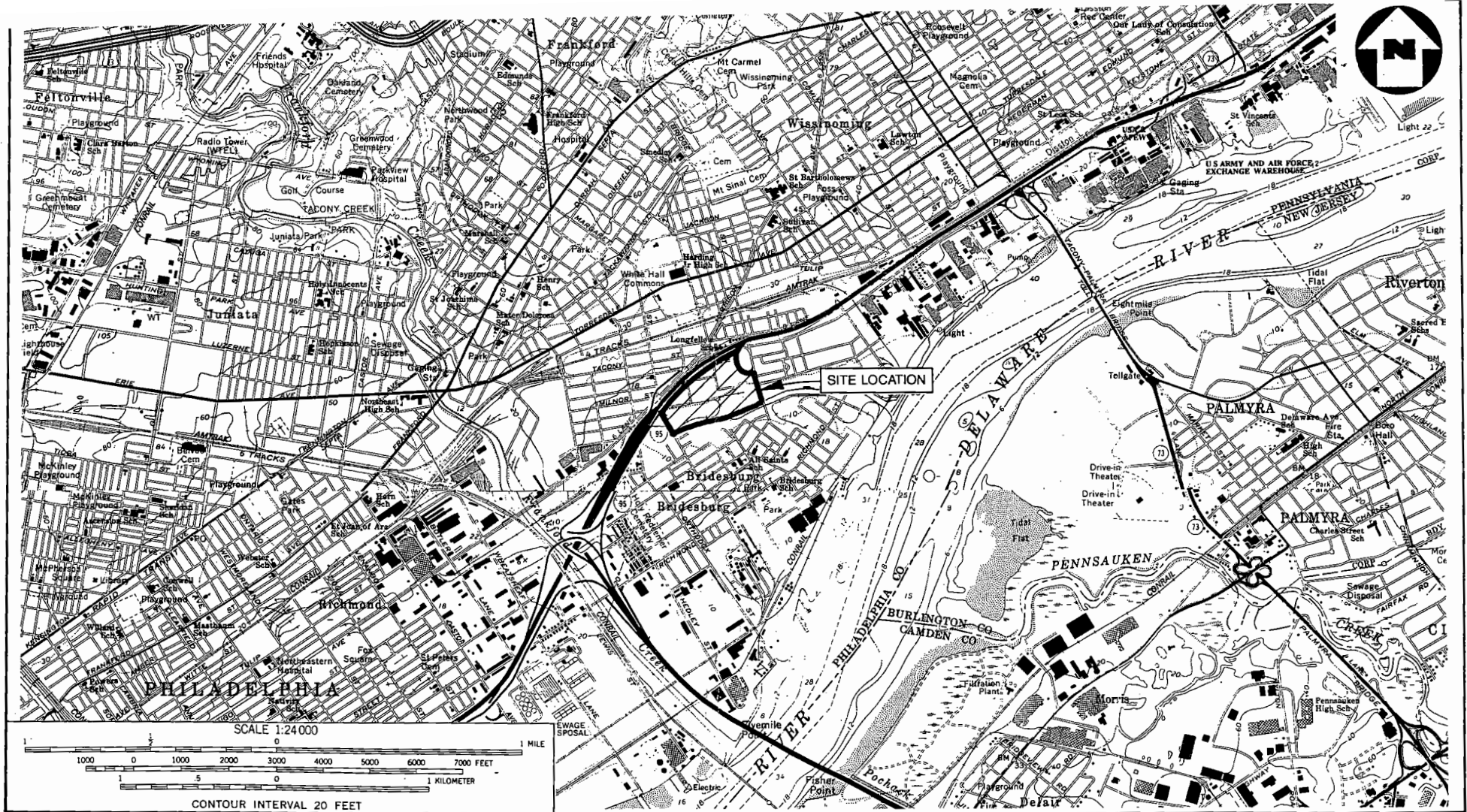
The Allied Frankford facility is located in northeastern Philadelphia at approximately 40° 00' 24" north latitude and 75° 04' 07" west longitude (see Figure 1-1). The property is bounded on the west by Margaret Street, on the north by Interstate 95, on the east by Bridge Street, and on the south by the Frankford Inlet, the Frankford Inlet sewer right-of-way, and Almond, Pratt, Belgrade, Ash, and Gaul Streets (see Figure 1-2). The Frankford Inlet discharges to the Delaware River approximately 1/2 mile east of the facility. Both the Frankford Inlet and the Delaware River are tidal in the reaches near the facility (Kearney, 1987).

The Frankford facility lies in the Bridesburg section of Philadelphia, Pennsylvania. Immediately adjoining the facility to the south is a densely populated residential area. A mixed residential/industrial area lies across Interstate 95 to the north of the facility. The TIP Trailer sales lot is located immediately west of the plant. The Frankford Arsenal and Rohm and Haas Delaware Valley, Incorporated, Philadelphia chemical plant are located east of the plant (Kearney, 1987).

The Allied property is generally flat and is situated five to 15 feet above mean sea level. The property gradually slopes to the south, toward the former Frankford Creek creekbed, which was rerouted circa 1952 (Kearney, 1987).

1.2 REGULATORY BACKGROUND

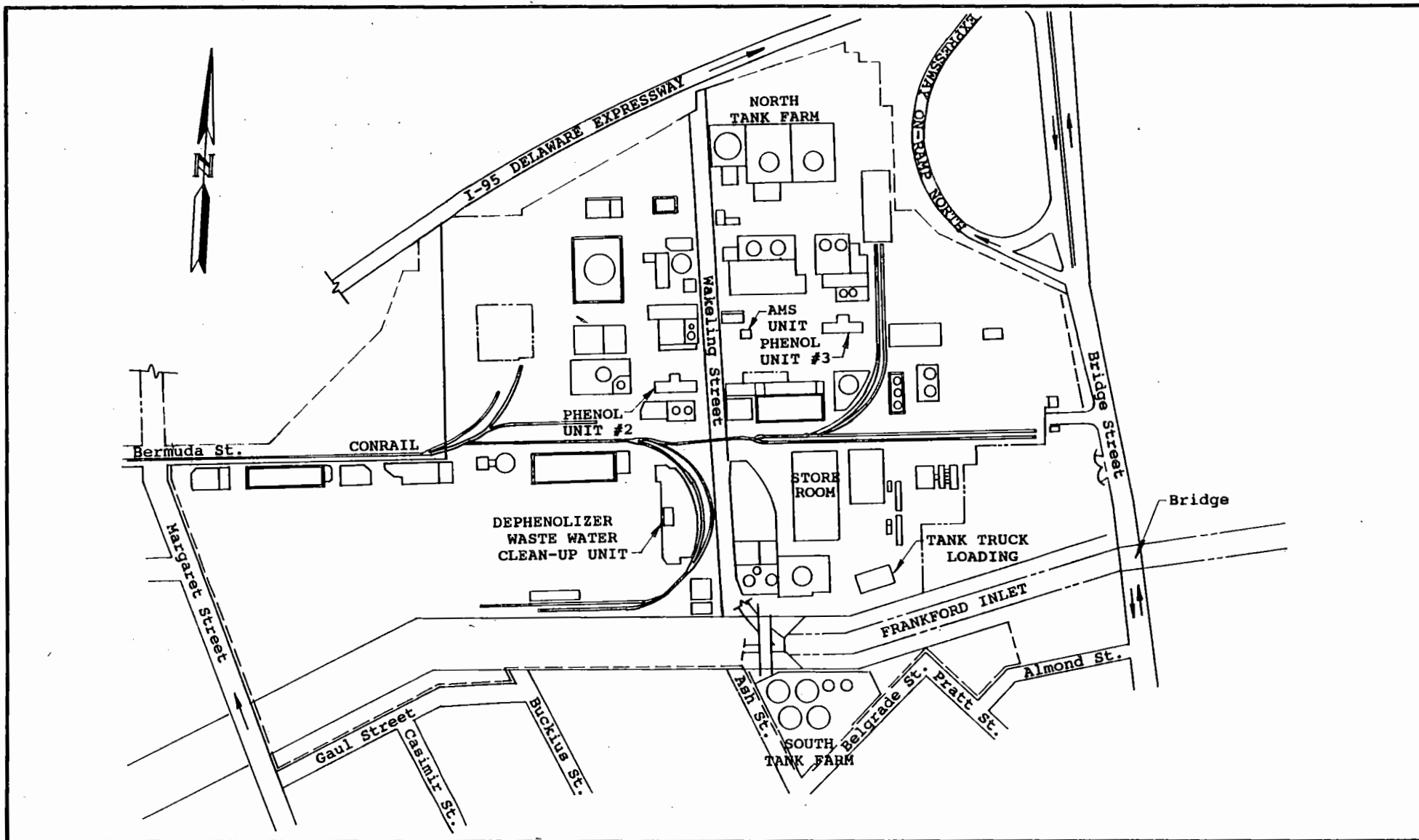
This Phase I RFI Report has been prepared in response to the requirements outlined in the RCRA Permit for Corrective Action for the Allied Fibers Frankford Plant. This permit was issued by the United States Environmental Protection Agency (EPA) in September 1990.



SITE LOCATION MAP
ALLIED FIBERS FRANKFORD PLANT
 (SCALE 1:24000)

FIGURE: 1-1

 **HALLIBURTON NUS**
 Environmental Corporation



GENERAL ARRANGEMENT
ALLIED FIBERS FRANKFORD PLANT
 (NO SCALE)

FIGURE: 1-2

The corrective action permit requires Allied to investigate 12 Solid Waste Management Units (SWMUs) and two Areas of Concern (AOCs). Table 1-1 presents a list of the 14 sites specified in the permit. The locations of these SWMUs/AOCs are shown on Figure 1-3. The first task of the RFI required the development of an RFI Work Plan. During development of this plan, Allied and EPA agreed to a phased approach to investigate the facility. A phased approach (for the groundwater investigation) was selected because of the dearth of existing data on shallow groundwater flow at the facility. The final Phase I RFI Plan was submitted to EPA in May 1991 (NUS, 1991). This plan was approved by EPA the following month. The RFI approach subdivided the facility into four study areas, based on similar unit operations, waste handling practices, historical uses, etc. The four study areas are listed below and are also shown on Figure 1-3:

- Study Area No. 1
 - AOC-1: Groundwater Recovery Wells
 - SWMU No. 46: Phenol Water System

- Study Area No. 2
 - AOC-2: Naphthalene-Contaminated Soil
 - SWMU No. 11: Past Landfill Area A
 - SWMU No. 12: Past Landfill Area B
 - SWMU No. 42: Former Creekbed

- Study Area No. 3
 - SWMU Nos. 19, 20, 21, and 30: Dephenolizer I Area
 - SWMU No. 49: Naphthalene Tank Bottoms

- Study Area No. 4
 - SWMU No. 2: Nonhazardous Waste Drum Storage Area
 - SWMU No. 3: Past Drum Storage Area (Facility C)
 - SWMU No. 5: Past Drum Storage Area (Facility E)

This report presents the results of the Phase I field effort, as outlined in the Phase I RFI Plan (NUS, 1991). The data generated during this effort, along with data collected previously at the site, are used to support the scoping of additional site studies or to provide support for a "no further action" determination, as appropriate.

TABLE 1-1

**LIST OF SOLID WASTE MANAGEMENT UNITS (SWMUs) AND AREAS OF CONCERN (AOCs)
 SUBJECT TO RCRA FACILITY INVESTIGATION
 ALLIED FIBERS FRANKFORD PLANT
 PHILADELPHIA, PENNSYLVANIA**

Number	Unit Description
2	Nonhazardous Waste Drum Storage Area
3	Past Drum Storage Area (Facility C)
5	Past Drum Storage Area (Facility E)
11	Past Landfill Area A
12	Past Landfill Area B
19	Past Dephenolizer I
20	Past Feed Tank to Dephenolizer
21	Pat Feed Tank to Dephenolizer
30	Past Feed Tank to Dephenolizer I (J2279)
42	Former Creekbed
46	Phenol Water System
49	Naphthalene Tank Bottoms
AOC-1	Groundwater Recovery Wells
AOC-2	Naphthalene-Contaminated Soils

Sources: EPA, September 1990, and Kearney, 1987.

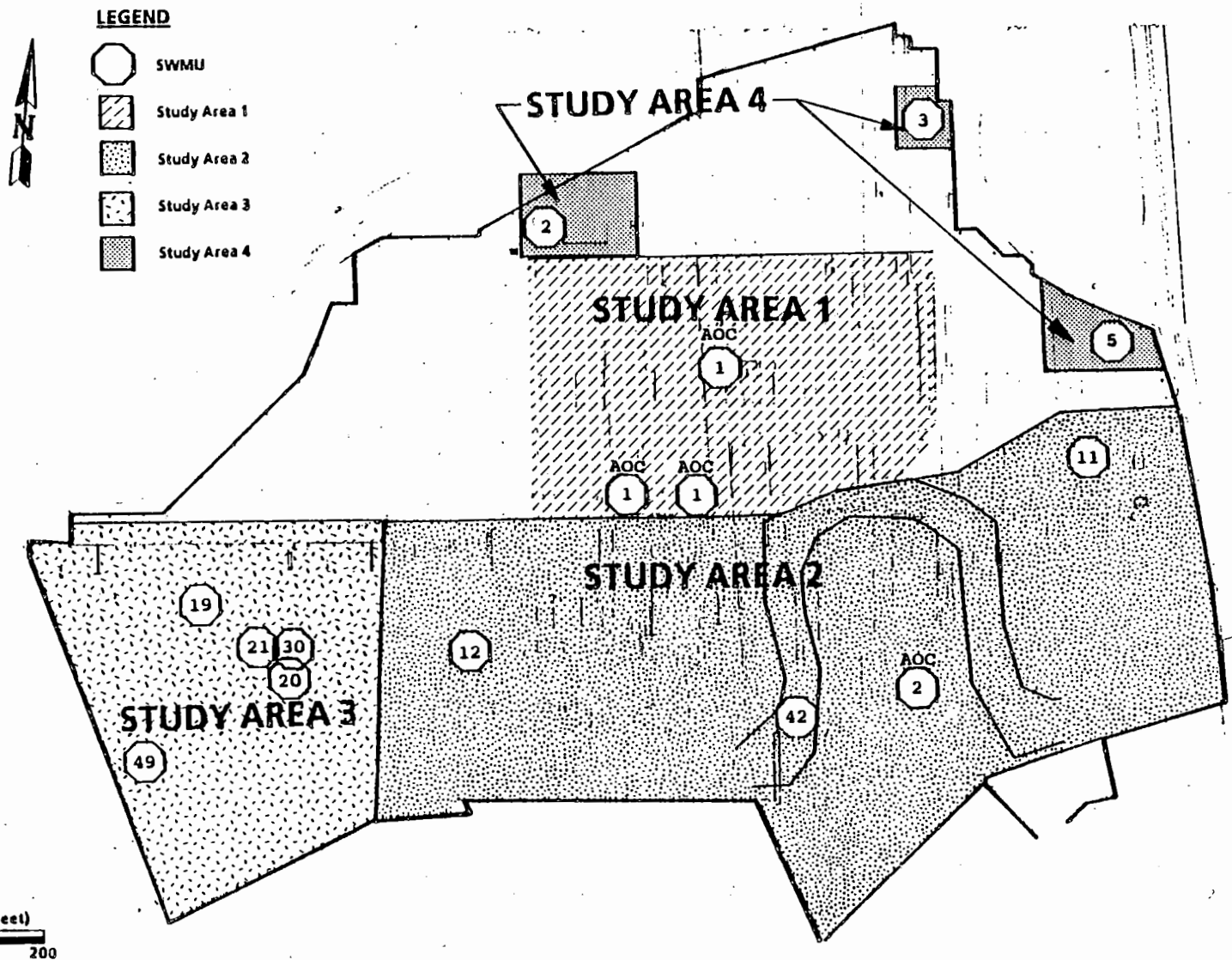


FIGURE: 1-3

SWMU AND STUDY AREA LOCATIONS
ALLIED FIBERS FRANKFORD PLANT

1.3 RFI OBJECTIVES

The objectives of the phased RFI as outlined in the Phase I Work Plan include the following: to collect data needed to assess the present and potential human health and environmental risks posed by the 12 SWMUs and two AOCs identified in the Permit for Corrective Action, and to obtain data needed to evaluate the feasibility of potential corrective measures.

The main objectives of the Phase I RFI were to determine the nature and extent of unsaturated soil contamination associated with the SWMUs/AOCs identified in the RCRA Permit for Corrective Action, as well as to initially characterize the nature and extent of groundwater contamination (EPA, September 1990).

For Study Area No. 1, the Phase I objectives were as follows:

- To initially evaluate the nature and extent of groundwater contamination.
- To determine whether deeper wells are needed to define the vertical extent of groundwater contamination.
- To determine whether additional wells are needed to define the horizontal extent of contamination.

For Study Area Nos. 2, 3, and 4, the Phase I objectives were as follows:

- To determine the nature and extent of soil contamination.
- To determine whether soil contaminants pose human health or environmental threats.
- To assess the need for further source delineation.

The tasks used to accomplish these objectives consisted of an existing piezometer-usability evaluation; an inventory of the facility's surface cover; installing, sampling for chemical analysis, and slug testing three monitoring wells; validating existing recovery well chemical analyses; and advancing soil borings to delineate the extent of the light non-aqueous phase liquid (LNAPL) layer and obtain soil samples from Study Area Nos. 2, 3, and 4 for organic chemical analysis. Data validation of the Phase I samples and a primarily qualitative risk assessment were also conducted.

1.4 FACILITY HISTORY

The following facility history, up to 1959, is excerpted primarily from "History of Frankford Plant (draft)," authored by T. Lee (1959). The post-1959 plant history was compiled from various sources, which are referenced where applicable.

Operations at the Frankford Plant commenced in 1884 on a 4.5-acre lot. The first owner, the H. W. Jayne Company, in conjunction with M. Ehret, Jr., and Company, initially employed 30 workers. The 1884 operations consisted of converting coal tar light oils and crude naphthalene to tar acid, solvent, and naphthalene products. Moth balls were made by hand.

In 1896, the Jayne Company was absorbed into the Barrett Manufacturing Company. By 1899, the plant area had increased to seven acres, and approximately 60 workers were employed. Production was on a relatively small scale: three months were required to produce 10 gallons of purified phenol, and two months were needed to produce the equivalent of a tank car full of benzene.

Between 1896 and 1916, new processes and products were introduced at the plant. In 1916, the plant area exceeded 17 acres, and 300 workers were employed. Operations in 1916 were bordered by Frankford Creek to the south, Margaret and Buckius Streets to the west, Bermuda and Stiles Streets to the north, and Wakeling Street to the east (Barrett, 1916). Products included benzene, toluene, naphthalene, anthracene, cresols (methylphenols), resorcinol, cresylic acid, nitrobenzene, nitrotoluene, nitronaphthalene, aniline, toluidine, naphthylamine, pyridine, carbazole, disinfectant oils, and semi-refined solvents and oils. Noted impurities included thiophene, carbon disulfide, acridene, and chrysogene (Barrett, 1916).

During World War I, Frankford's product line was expanded to include the production of basic coal chemicals and derivatives required for the production of trinitrotoluene (TNT), picric acid, dyestuffs, and pharmaceuticals. Previously, many of these products could be obtained only from Germany. By 1918, the plant had expanded to include 76 buildings, with 1,000 employees. The first phenol production unit at the Frankford Plant was constructed in 1918.

In 1920, the Barrett Manufacturing Company was incorporated into the Allied Chemical Corporation. Also at this time, Frankford operations were limited to the separation and purification of coal chemicals found in carbolic oils and light oils. Frankford's remaining products included refined benzene, toluene, and xylene; various semi-refined solvents; tar acids (phenol, cresols, and cresylic acids); pyridine, alpha-picoline, beta- and gamma-picoline, lutidine, and collidine; crude and refined naphthalenes (including methylnaphthalene); and coumarene-indene resins. Treatment of light oils and carbolic oils continued at Frankford until 1960 and 1972, respectively (Allied Chemical, 1978).

During the late 1930s, production of coal chemical derivatives and synthetics resumed at Frankford. From 1935 to 1945, 4-chloro-m-cresol was reportedly produced. Additionally, 1,3,5-xylenol production commenced at this time. This production was discontinued in 1971 (Allied Chemical, 1978).

In 1937, the first phthalic anhydride unit was constructed at the Frankford Plant. Phthalic anhydride was produced from refined naphthalene. A second phthalic anhydride unit was installed at the plant in 1942, and a third unit was constructed in 1955. In 1969, approximately 100 million pounds of phthalic anhydride were produced. Small amounts of by-products, chiefly naphthoquinone and maleic anhydride, were created during the production of phthalic anhydride. During 1972, a fire in the phthalic anhydride production unit led to the cessation of phthalic anhydride manufacturing operations at Frankford (Allied Chemical, 1976).

In 1940, a second phenol plant using the sulfonation fusion process was placed into operation. This plant operated until 1953, when Frankford converted to the cumene-phenol process.

In 1942, Frankford began converting some of its phthalic anhydride production into phthalate esters, using purchased alcohols (e.g., butanol and hexanol). The principal product during World War II was dibutyl phthalate. After 1945, dioctyl phthalates (2-ethylhexyl, isooctyl, and capryl) became the most important products. Adipate plasticizers were also produced prior to 1969, using solid adipic acid in place of phthalic anhydride. In 1971-1972, production of plasticizers at Frankford was terminated (Allied Chemical, 1978).

In 1944, nicotinic acid (niacin) production from quinoline (a heavy tar base derivative) commenced. Production of quinoline was initiated simultaneously. Quinaldine and isoquinoline were also reportedly produced. In 1962, the nicotinic acid production was discontinued (Allied Chemical, 1976).

About 1952, Frankford Creek was straightened, and the meander on the Allied property was backfilled. The fill material may have included ash from the City of Philadelphia's incinerator plants.

Production of phenol and acetone by the cumene process was initiated at Frankford in early 1954. At this time, cumene was produced at Frankford by reacting propylene with benzene. By-products of the phenol process included alpha-methylstyrene (AMS) and acetophenone. In 1954, an explosion damaged Phenol Production Unit No. 1, which was rebuilt. In 1960, a second synthetic cumene phenol plant was placed into production. A third plant was added in 1964. In 1982, an explosion and fire damaged part of the phenol production facilities (Phenol Unit No. 1). These facilities were partially rebuilt in 1983. The cumene phenol process is the only remaining production currently occurring at Frankford (Allied-Signal, 1987).

In 1955, a major fire damaged the cumene production unit at the Frankford Plant. This unit was rebuilt shortly thereafter. Cumene production at the Frankford Plant ceased around 1960, when it became cheaper to buy cumene from local refineries than to make it at Frankford.

Prior to 1955, all Frankford wastewaters were treated and discharged to Frankford Creek. Beginning in 1955, Allied began discharging the majority of its wastewaters to the Philadelphia Northeast Water Pollution Control Plant. At this plant, wastewaters are also biologically treated.

During strikes in 1960 and 1966, approximately 700 tons of phthalic anhydride mother liquor were reportedly temporarily landfilled at the plant at two locations [adjacent to Bridge Street and near the former spray ponds (SWMU Nos. 11 and 12, respectively)]. This material was reportedly excavated and disposed off site after the strikes were settled.

In 1973, Allied began the demolition of outmoded facilities (i.e., the non-phenol-production facilities). This program continued through 1978.

Late in 1981, Allied discovered a layer of cumene floating on top of the water table beneath Phenol Process Unit No. 2. Groundwater withdrawal to contain this layer commenced in June 1984. This withdrawal system is currently operating.

In December 1982, approximately 11,000 gallons of 50 percent caustic escaped from a ruptured tank. A groundwater withdrawal system to recover the caustic was installed in May-June 1983. This withdrawal is currently continuing (see Section 4.1).

An Allied employee also reported that unknown quantities (believed to be less than 200 cubic yards) of naphthalene, tar acid, and tar base sludges generated from tank demolition activities were also disposed on site (SWMU No. 49).

The history of permits issued to Allied can be found in the Phase I RFI Plan, Volume 1 (NUS, 1991). Currently, the plant has an National Pollutant Discharge Elimination System (NPDES) permit to discharge water softener backwash, non-contact cooling water, and storm runoff to Frankford Inlet (NUS, 1991). The Allied plant also has a permit from the city of Philadelphia to discharge process wastewater, recovered groundwater, sanitary wastewater, and some stormwater to the Philadelphia Northeast Water Pollution Control Plant (NUS, 1991). The plant also has approximately 39 air pollution operating licenses (to construct) and permits (to operate) from the city of Philadelphia (NUS, 1991).

1.5 REPORT ORGANIZATION

The Phase I report is organized as follows:

Section 2.0 includes a discussion of field procedures, analytical procedures, contaminant fate and transport properties, and approaches to the health and environmental assessment. The latter section includes a discussion of potentially applicable criteria and guidelines. Sections 2.3 and 2.4 include fate, transport, and risk assessment information common to all four study areas.

Section 3.0 contains a discussion of the environmental setting, including information about climate, geology, surface water, hydrogeology, and local water and land uses.

Sections 4.0 through 7.0 consider the study areas individually. Each section consists of a description, summary of previous and Phase I investigation activities, site characteristics, nature and extent of contamination, contaminant fate and transport, health and environmental assessment, and conclusions and recommendations.

2.0 FIELD PROCEDURES

2.1 GENERAL FIELD PROCEDURES

This section briefly describes the standard operating procedures (SOPs) used by HALLIBURTON NUS during the RFI performed in December 1991 and January and February 1992. All the procedures are referenced and appended to the approved RFI Plan (NUS, 1991).

Samples of several different media were collected. Upon collection of each sample, a unique sample identification number was assigned as discussed in the RFI Plan (NUS, 1991). As samples were collected, they were prepared and packaged for shipment to the analytical laboratory in accordance with the RFI Plan (NUS, 1991).

Documentation of sampling activities included the completion of sample labels, chain-of-custody records, custody seals, sample log sheets, and maintenance equipment calibration log forms.

2.1.1 Field Operations and Sampling Procedures

This section describes the activities performed during the RFI field work conducted in December 1991 and January and February 1992. Activities performed included the drilling and continuous sampling of 60 soil borings, the drilling and installation of three monitoring wells, aquifer testing, an existing well evaluation, subsurface soil sampling, and groundwater sampling. The locations of the soil borings and monitoring wells installed during Phase I of the RFI and the locations of existing piezometers, recovery wells, and selected soil borings from previous investigations are shown on Figure 2-1.

Sixty soil borings were drilled and logged within the four study areas of the site described in Section 1.2 to determine the lithology of the geologic formations underlying the site, to determine the composition and thickness of subsurface fill or waste materials at the site, and to delineate a previously detected LNAPL layer. The soil borings ranged in depth from 4 to 42 feet. Hollow-stem auger drilling methods were employed in accordance with the RFI Plan (NUS, 1991), and samples were obtained in accordance with American Society for the Testing of Materials (ASTM) D1586-84. Soil samples obtained for lithologic description were described in accordance with HALLIBURTON NUS SOP GH-1.5.

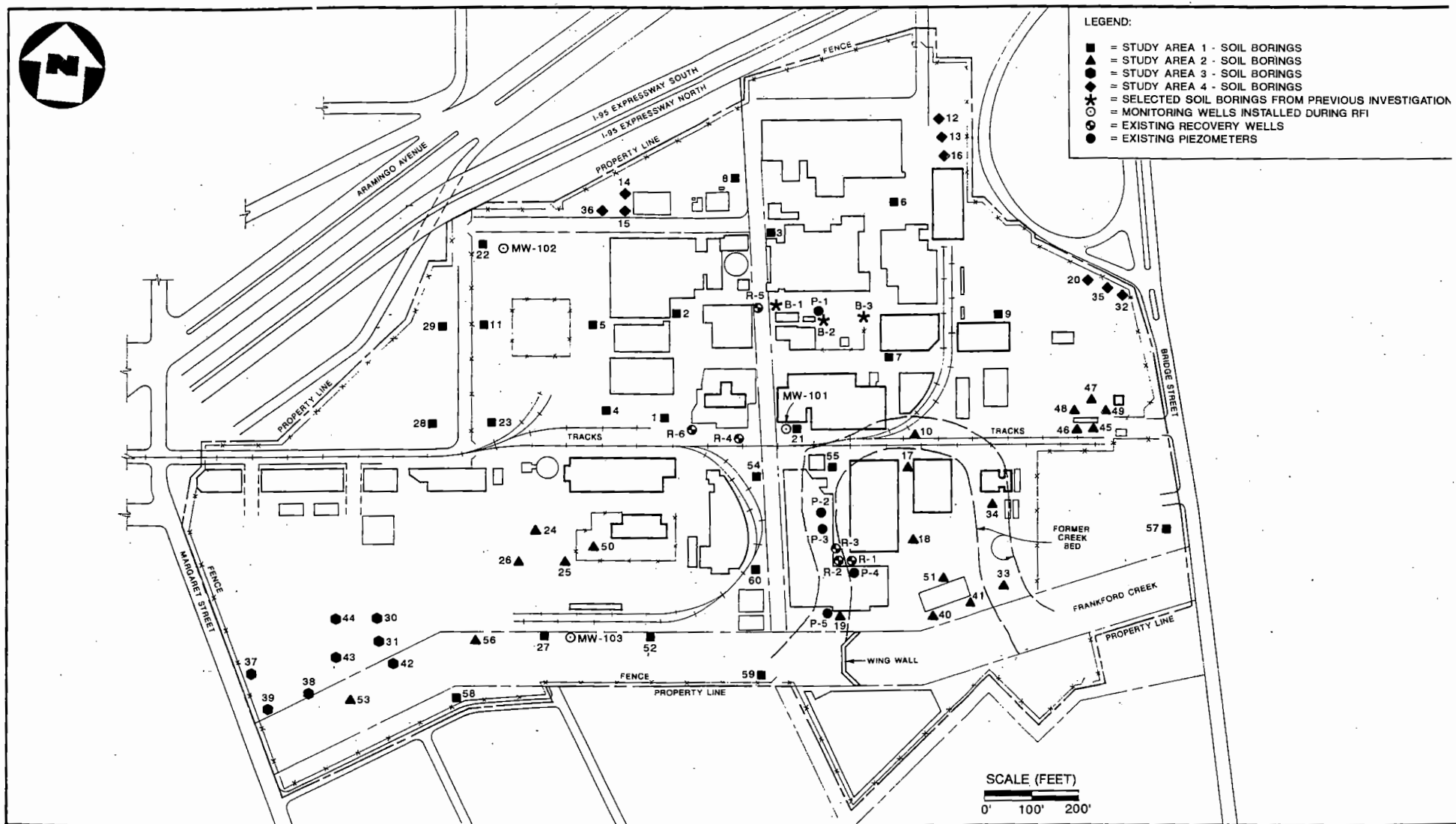


FIGURE: 2-1

Three monitoring wells were drilled and installed for Study Area No. 1. The monitoring wells range in depth from 15 to 20 feet below the top of casing. The wells were installed using hollow-stem augers and were constructed in accordance with the the RFI Plan (NUS, 1991). Soil samples were taken for lithologic description of the monitoring well boreholes.

Hydraulic conductivity testing was performed on each well after installation. Hydraulic conductivities were calculated from records of water-level recovery versus time. Data were generated from rising head slug tests, which consisted of lowering the level of static water in each well and measuring the recovery using pressure transducers and data loggers.

Eleven existing recovery wells and piezometers were located and evaluated for their suitability as groundwater monitoring points during the RFI field work. Construction materials and dimensions and total depths and water levels for five piezometers and recovery well nos. R-1, R-2, and R-3 were observed, measured, and recorded in accordance with the RFI Plan (NUS, 1991). Data for recovery well nos. R-4, R-5, and R-6 are available from blueprints supplied by Allied.

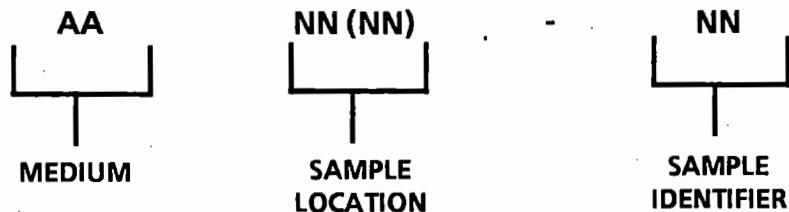
Thirty-seven soil samples [not including quality assurance/quality control (QA/QC) blanks and duplicates)] were obtained for laboratory chemical analysis from Study Area Nos. 2, 3, and 4. Ten subsurface samples from Study Area Nos. 1, 2, and 3 were submitted for grain size distribution analysis. Groundwater samples were obtained from the three newly installed monitoring wells. All drilling and sampling equipment were decontaminated between boreholes and samples.

Sample logsheets were completed for each sample collected, and all pertinent field data were recorded in the site logbook assigned for this project.

2.1.2 Sample Identification System

Each sample taken for the Allied Fibers Frankford Plant Phase I RFI was assigned a unique sample tracking number. The sample tracking number consists of a three-segment, alpha-numeric code that identifies the sample medium, location, and sample depth (in the case of soil samples) or the sampling event (in the case of monitoring well samples). Any other pertinent information regarding sample identification will be recorded in the field logbooks.

The alpha-numeric coding used in the sample number system is explained in the following diagram and the subsequent definitions:



Character type:

- A = Alpha
- N = Numeric

Medium:

- MW = Groundwater from monitoring well, or quality control (QC) blank
- SO = Soil

Sample Location:

Locations of a given medium are numbered sequentially beginning with "01." The first boring for this study is numbered sequentially beginning with "01" to maintain a consistent numbering system. Shallow monitoring wells are sequentially numbered beginning with "MW-101" to distinguish the shallow monitoring well numbering system from the existing recovery well system. (Medium-depth and deep wells, if installed during subsequent phases, will be numbered beginning with "200 series" and "300 series" numbers, respectively.)

Sample Identifier:

For soil samples = Depth, in feet, of sample

For other media = Sample round

For example, a groundwater sample collected during Round 1 from Monitoring Well No. 102 (first phase of sampling) would be designated as MW102-01.

A groundwater sample collected during Round 2 from the same well during Phase 2 of sampling would be designated as MW102-02.

A subsurface soil sample taken from Boring No. 26 at a depth of four to five feet would be designated as SO26-04.

All QC samples were coded as field samples in order not to identify the QC sample to the laboratory. QC samples are noted in the field log. For example, a duplicate of sample SO26-04 was designated as SO26-05. The first QC blank collected on December 13, 1991 was identified as MW 1213-01. Information regarding sample labels attached before shipment to the laboratory is contained in Section 5.2 of NUS SOP SA-6.1 [see Appendix A of the RFI Plan (NUS, 1991)]. Appendix B of the RFI Plan contains an example of the sample label and chain-of-custody seal used (NUS, 1991).

2.1.3 Deviations from Sampling and Analysis Plan

Several deviations from the tasks prescribed by the RFI Plan (NUS, 1991) occurred during the RFI field work. These include postponement of the seven-day groundwater-level monitoring program until Phase II of the RFI, the completion of several additional soil borings in Study Area No. 1, the abandonment of two of the deep soil borings before reaching bedrock at total depth, and changes in some of the monitoring well and soil boring locations with respect to those shown in the RFI Plan (NUS, 1991).

The decision to postpone the seven-day groundwater-level monitoring program until Phase II of the RFI was made based upon review of the results from the soil boring program for Study Area No. 1. The extent of the LNAPL layer was determined to be larger than anticipated during the development of the RFI Plan (NUS, 1991). Thus, the locations of the newly installed monitoring wells adjacent to the LNAPL area are at greater-than-expected distances from one another and from the existing recovery wells. It was determined that the groundwater-level monitoring program would be of more value in describing site hydrologic conditions if it were conducted during the next phase of the RFI, when additional wells and piezometers will be available for monitoring.

Eleven additional soil borings were added to the investigation for Study Area No. 1. These borings were added to complete delineation of the LNAPL layer, which was of greater lateral extent than previously anticipated.

Two soil borings (No. 55, Study Area No. 1, and No. 56, Study Area No. 2) were not advanced to bedrock as specified in the RFI Plan (NUS, 1991). Each of these borings encountered significant levels of contamination based on photoionization detector readings and visual observations. Relatively uncontaminated and impervious clay layers were encountered underlying the contaminated zones in each boring. The borings were not advanced beyond the clay layer to avoid the risk of spreading contamination to underlying zones.

Actual soil boring locations were chosen with the assistance of Allied personnel based on historical maps, aerial photographs of site facilities, and the results of previously completed borings. Some changes in soil boring locations were caused by the presence of underground utilities or overhead product line locations and by areas of auger refusal. The proposed Study Area No. 2 boring location in the northwestern part of the former creekbed meander (SWMU No. 42) was moved to the filled creekbed in the southwestern part of the site to investigate differences in fill material between the creekbed and the former meander. The monitoring well locations were chosen after delineation of the LNAPL layer to determine the general direction of groundwater flow.

2.2 ANALYTICAL PROCEDURES AND DATA VALIDATION

2.2.1 Analytical Program

The analytical program for the Phase I RFI was conducted in accordance with the RFI Plan (NUS, 1991). This program is summarized below. Deviations from the planned analytical program are noted.

All samples for volatile organic analysis (VOA), base-neutral/acid extractable analysis (BNA), and pesticide/PCB analysis were conducted in accordance with the EPA Contract Laboratory Program (CLP) February 1988 Statement of Work (SOW). Cumene and alpha-methylstyrene (AMS) were target compounds for the VOA analysis in addition to the standard CLP Target Compound List (TCL).

All metals samples were analyzed in accordance with the July 1988 CLP SOW.

All samples for total organic carbon (TOC) analysis were analyzed using the Walkley-Black method, as described in Methods of Soils Analysis (ASA, 1986). All the preceding analyses were performed by the HALLIBURTON NUS laboratory in Pittsburgh, Pennsylvania.

Samples for organophosphorus pesticide and herbicide analysis were analyzed in accordance with EPA Methods 8140 and 8150, respectively. These analyses were performed by the Resource Analysts, Incorporated (RAI) New Hampshire laboratory.

Samples for the dioxin screening analysis were analyzed using EPA Method 8270. These analyses were performed by the HALLIBURTON NUS laboratory in Houston, Texas.

2.2.2 Data Validation

All laboratory data generated during the Phase I RFI were validated by HALLIBURTON NUS chemists. In addition, groundwater data collected in September 1990 from groundwater recovery wells R-2, R-3, R-5, and R-6 were validated. (The latter data were generated by Pacific Analytical.)

Data validation was performed in accordance with EPA functional guidelines for validation of organic and inorganic analyses, as well as any EPA Region III amendments to these guidelines. All data generated during the RFI, as well as the September 1990 recovery well data, were determined to be usable. Analytical results are presented in Sections 4.0 through 7.0; the complete analytical database is presented in Appendix A.

2.3 CONTAMINANT FATE AND TRANSPORT

Various aspects of contaminant fate and transport at the Allied Fibers Frankford facility are discussed in this section. Properties that affect contaminant migration are presented in Section 2.3.1. Section 2.3.2 presents a brief discussion of contaminant persistence.

2.3.1 Chemical and Physical Properties of Site Contaminants

Various chemical and physical properties of chemicals detected during the Phase I investigation and in the previously collected recovery well samples are presented and discussed in this section. The complete analytical database is presented in Appendix A; results are discussed by Study Area in Sections 4.0 through 7.0. These parameters are used to estimate the environmental behavior of site chemicals. Physical and chemical properties of the organic compounds are presented in Table 2-1. Environmental fate-related properties of inorganics are presented in Table 2-2.

Empirically determined literature values of the water solubility, octanol/water partition coefficient (K_{OW}), organic carbon/water partition coefficient (K_{OC}), vapor pressure, bioconcentration factor (BCF), and specific gravity are presented, when available. Calculated values were obtained using approximation methods where noted, if literature values were unavailable.

2.3.1.1 Specific Gravity

Specific gravity is the ratio of the weight of a given volume of pure chemical at a specified temperature to the weight of the same volume of water at the given temperature. Its primary use is to determine whether a contaminant will have a tendency to float or sink in water if it is present as a pure compound or at very high concentrations. Contaminants with a specific gravity greater than 1 will tend to sink, whereas contaminants with a specific gravity less than 1 will tend to float. However, solubility also can affect sinking and floating tendencies, as discussed in Section 2.3.1.3. Of the contaminants commonly detected during Phase I, cumene and the benzene-toluene-ethylbenzene-xylene (BTEX) compounds have specific gravities less than 1.0, and the cresols (methylphenols) have reported specific gravities greater than 1.0. Specific gravity values for other detected chemicals are listed in Table 2-1.

TABLE 2-1
PHYSICAL AND CHEMICAL PROPERTIES OF ORGANIC COMPOUNDS
DETECTED IN ENVIRONMENTAL SAMPLES
ALLIED FIBERS FRANKFORD PLANT
PHILADELPHIA, PENNSYLVANIA

CHEMICAL	MOL WT ⁽¹⁾⁽³⁾ (g)	SOL ⁽¹⁾⁽²⁾⁽³⁾ (mg/l)	LOG K _{OW} ⁽²⁾⁽³⁾⁽⁴⁾	VP ⁽¹⁾⁽²⁾⁽³⁾ (mm Hg, 20C)	H ⁽¹⁾⁽³⁾ (atm m ³ /mol)	BCF ⁽¹⁾⁽⁶⁾⁽⁷⁾	SP GR ⁽²⁾⁽⁵⁾ (@ 20C)	K _{OC} ⁽¹⁾
Methylene Chloride	84.94	20,000	1.25	362	2.03E-3	6	---	8.8
Acetone	58.08	680,000	- 0.24	270	3.43E-5	3E-1	0.791	9.2
2-Butanone	72.1	353,000	0.26	78	2.08E-5	6E-1	0.805	17
Benzene	78.12	1,780 (25C)	2.13	95.2	5.5E-3	7.84	0.8786	65
Toluene	92.13	534.8 (25C)	2.69 (20C)	28.7	6.66E-3	25	0.867	300
Ethylbenzene	106.16	152	3.15	7	6.6E-3	66.8	0.867	1.1E3
Xylenes	106.16	187	2.77 - 3.2	6.5	4.33E-3	1.5E-2	0.86 - 0.88	248
Styrene	104.14	300	3.16	5	2.28E-3	1.2	0.9045 (25C)	568
2-Methylphenol	108.1	8,700	1.95	2.4E-1	3.92E-6	11	1.041	24.5
4-Methylphenol	108.1	4,400	1.92/1.94	4E-2	1.29E-6	11	1.0347	24.3
2,4-Dimethylphenol	122.2	590 (25C)	2.42	6.2E-2	1.7E-5	75	1.036	96
Pyridine	79.1	---	0.65	14	---	---	0.982	10 - 60 ⁽⁶⁾
2,4,5-T	255.5	278 (25C)	4	5.25E - 9 (25C)	---	23 - 43	1.80	86 - 280 ⁽⁶⁾
1,2-Dichloroethane	98.96	8,690	1.45	61	9.14E-4	9	1.24 ⁽⁶⁾	14
Trans-1,2-Dichloroethene	96.94	600	1.48	3.26E-2	6.7E-2	48	1.26	59
Trichloroethene	131.39	1,100	2.53	57.9	9.1E-3	97	1.46	126.2
Tetrachloroethene	165.83	200	2.6 (20C)	14	1.53E-2	252	1.626	364
Carbon Disulfide	76.14	2,300 (22C)	1.84/2.16	260	1.13E-2 ⁽⁷⁾	11	1.263	142
p-Cymene	134.22	340	4.10	1 (17.3C)	---	104/770	0.8533 (25/4)	770/4, 050 ⁽⁶⁾
Diphenyl ether	170.20	21 (25C)	4.20	0.02 (25C)	---	---	1.073	---

TABLE 2-1
 PHYSICAL AND CHEMICAL PROPERTIES OF ORGANIC COMPOUNDS
 DETECTED IN ENVIRONMENTAL SAMPLES
 ALLIED FIBERS FRANKFORD PLANT
 PAGE TWO OF FOUR

CHEMICAL	MOL WT ⁽¹⁾⁽³⁾ (g)	SOL ⁽¹⁾⁽²⁾⁽³⁾ (mg/l)	LOG K _{OW} ⁽²⁾⁽³⁾⁽⁴⁾	VP ⁽¹⁾⁽²⁾⁽³⁾ (mm Hg, 20C)	H ⁽¹⁾⁽³⁾ (atm m ³ /mol)	BCF ⁽¹⁾⁽⁶⁾⁽⁷⁾	SP GR ⁽²⁾⁽⁵⁾ (@ 20C)	K _{OC} ⁽¹⁾
n-Hexadecane	226.45	9E-4 (25C)	---	1 (105C)	---	---	0.7749	---
n-Eicosane	282.56	---	---	10 (198C)	---	---	0.788 (37C)	---
n-Tetracosane	338.66	---	---	---	---	---	---	---
Isophorone	138.2	12,000	1.7	0.38	5.75E-6	48	0.92	87
Biphenyl	154.2	7.5 (25C)	3.95	1 (70.6C)	4.08E-4	---	1.18 (0/4C)	---
Acetophenone	120.15	5,500	1.58	1 (15C)	---	5 - 9	1.03	21 - 269 ⁽⁶⁾ ; 35 ⁽⁸⁾
Benzoic Acid	122.13	2,900	1.87	2.23E-2	7E-8	11	1.27	150
Phenol	94.11	93,000	1.46	3.41E-1	4.54E-7	9.4	1.07	14.2
n-Tetradecane	198.4	2.2E-3 (25C)	---	1 (56C)	---	---	0.7628	---
alpha-Naphthylamine	143.19	1,700	2.22	1 (104.3C)	---	30, 9	1.131	2,688 - 3,777 ⁽⁶⁾
beta-Naphthylamine	143.19	---	2.25	1 (108C)	---	---	1.061 (98/4C)	---
Hexanoic Acid	116.16	1.1E4	1.88/1.92	0.2	1.88	---	0.945 (0C)	---
Chlorobenzene	112.56	500	2.84	11.7	3.58E-3	164	1.1066	330
Cumene	120.19	50 (20C)	3.66	3.2	1.46E-2	35.5	0.862	2,800 + ⁽⁶⁾
alpha-Methyl Styrene	118.18	560 (25C) ⁽⁶⁾	3.35 ⁽⁶⁾	1 (74C)	---	29.5	0.9082	135 - 1,585 ⁽⁶⁾
4-Methyl-2-Pentanone	100.2	17,000	1.19 ⁽⁶⁾	6	4.16E-5	5.2	0.8017	113
N-Nitrosodiphenylamine	198.2	40	2.79	1E-1	6.6E-4	426	1.23 ⁽⁶⁾	648
Acenaphthylene	152.20	3.93 (25C)	4.07	9.12E - 4 (25C) ⁽⁶⁾	1.14E-4	128 - 575	0.899	950 - 3,315 ⁽⁶⁾
Acenaphthene	154.2	3.42 (25C)	3.92	1.55E-3 (25C)	9.1E-5	1.8E3	1.0242	4.6E3

TABLE 2-1
PHYSICAL AND CHEMICAL PROPERTIES OF ORGANIC COMPOUNDS
DETECTED IN ENVIRONMENTAL SAMPLES
ALLIED FIBERS FRANKFORD PLANT
PAGE THREE OF FOUR

CHEMICAL	MOL WT ⁽¹⁾⁽³⁾ (g)	SOL ⁽¹⁾⁽²⁾⁽³⁾ (mg/l)	LOG K _{OW} ⁽²⁾⁽³⁾⁽⁴⁾	VP ⁽¹⁾⁽²⁾⁽³⁾ (mm Hg, 20C)	H ⁽¹⁾⁽³⁾ (atm m ³ /mol)	BCF ⁽¹⁾⁽⁶⁾⁽⁷⁾	SP GR ⁽²⁾⁽⁵⁾ (@ 20C)	K _{OC} ⁽¹⁾
Dibenzofuran	168.2	10	4.12	4.4E-3 (25C) ⁽⁶⁾	---	82 - 2,858	1.0886 (99/4)	4,600 - 6,350 ⁽⁶⁾
Fluorene	116.2	1.69 (25C)	4.18	7.1E-4	6.4E-5	3.8E3	1.203	7.3E3
Phenanthrene	178.23	0.816 (21C)	4.46	1 (118.2C)	3.93E-5	---	1.025	2.3E4 ⁽⁶⁾
Anthracene	178.2	0.045 (25C)	4.45	1.7E5 (25C)	8.6E-5	4.7E3	1.283	1.4E4; 26,000 ⁽⁸⁾
Dibenzothiophene	184.26	---	---	---	---	---	---	11,220 ⁽⁸⁾
Fluoranthene	202.3	0.26 (25C)	5.33	5E-6 (25C)	6.5E-6	1.2E4	1.252	3.8E4
Pyrene	202.3	0.13 (25C)	5.18	2.5E-6 (25C)	5.1E-6	1.2E4	---	3.8E4
Naphthalene	128.2	31.7 (25C)	3.01/3.45	8.7E-3 (25C)	4.6E-4	4.2E2	1.152	9.4E2
Thianaphthene	134.2	---	3.09	---	---	---	1.15	---
2-Methylnaphthalene	142.2	26 (25C)	3.86	10 (105C)	---	28 - 300	0.994	8,500 ⁽⁶⁾
Benz(a)anthracene	228.28	0.0057	5.61	2.2E-8	1E-6	5.3E4	---	2E5
Chrysene	228.3	0.0018 (25C)	5.61	6.3E-9 (25C)	1.05E-6	5.3E4	1.274	2E5
Benzo(b)fluoranthene	252.3	0.0014 (25C)	6.57	5E-7	1.22E-5	1.4E5	---	5.5E5
Benzo(k)fluoranthene	252.3	0.0043 (25C)	6.84	5E-7	3.87E-5	1.4E5	---	5.5E5
Benzo(a)pyrene	252	0.0038 (25C)	5.98	5.6E-9	4.9E-7	1.09E4	---	5.5E6
Indeno(1,2,3-c,d)pyrene	276.3	0.00053 (25C)	7.66	1E-10	6.95E-8	3.5E5	---	1.6E6
Dibenz(a,h)anthracene	278.4	0.0005 (25C)	5.97	1E-10	7.3E-8	6.9E5	---	3.3E6
Benzo(g,h,i)perylene	276	0.00026 (25C)	7.23	1.03E-10 (25C)	1.44E-7	3.5E5	---	1.6E6

TABLE 2-1
PHYSICAL AND CHEMICAL PROPERTIES OF ORGANIC COMPOUNDS
DETECTED IN ENVIRONMENTAL SAMPLES
ALLIED FIBERS FRANKFORD PLANT
PAGE FOUR OF FOUR

CHEMICAL	MOL WT ⁽¹⁾⁽³⁾ (g)	SOL ⁽¹⁾⁽²⁾⁽³⁾ (mg/l)	LOG K _{OW} ⁽²⁾⁽³⁾⁽⁴⁾	VP ⁽¹⁾⁽²⁾⁽³⁾ (mm Hg, 20C)	H ⁽¹⁾⁽³⁾ (atm m ³ /mol)	BCF ⁽¹⁾⁽⁶⁾⁽⁷⁾	SP GR ⁽²⁾⁽⁵⁾ (@ 20C)	K _{OC} ⁽¹⁾
Di-n-butyl Phthalate	278.3	13 (25C)	5.2	1E-5 (25C)	2.8E-7	4.7E4	1.0465	1.7E5
Bis(2-ethylhexyl) Phthalate	390.62	0.4 (25C)	5.3	2E-7	3E-7	2.3E8	0.99	2E9
Di-n-octyl Phthalate	391	3 (25C)	9.2	1.4E-4	1.7E-5	3.9E8	0.99	3.6E9

MOL WT = Molecular weight

SOL = Solubility

KOW = Octanol/water partition coefficient

VP = Vapor pressure

H = Henry's Law constant

BCF = Bioconcentration Factor

SP GR = Specific gravity

KOC = Organic carbon partition coefficient

(1) EPA, December 1982

(2) Verschueren, 1983

(3) EPA RREL

(4) Versar, 1979

(5) Weast, 1988

(6) NLM, April 7, 1992

(7) Estimated as per Lyman, 1990

(8) Dragun, 1988

**TABLE 2-2
PROPERTIES OF INORGANIC CHEMICALS
ALLIED FIBERS FRANKFORD PLANT
PHILADELPHIA, PENNSYLVANIA**

METAL	MOL WT (g) (1)	BCF		$K_d^{(4)}$ (ml/g)	DESCRIBED ENVIRONMENTAL FATE ⁽²⁾
		(2)	(3)		
Arsenic	74.92	333	0 - 17	1 - 8.3	Sorption important
Barium	137.34	---	---	---	---
Beryllium	9.0122	100	19	---	Sorption important; many species mobile
Cadmium	112.4	1,000 - 4,000	2 - 3,520	1.3 - 27	Bioaccumulation, sorption important
Chromium	51.996	70 - 4,000	< 1 - 2.8	III: 470 - 150,000 VI: 1.2 - 1,800	Cr VI soluble, mobile; Cr III insoluble
Copper	63.54	12 - 30,000	0 - 2,000	1.4 - 333	Sorption, bioaccumulation important
Lead	207.19	60 - 200	42 - 1,700	4.5 - 7,640	Sorption, bioaccumulation important
Manganese	55	---	---	0.2 - 10,000	---
Mercury	200.59	1,000 - 100,000	4,994 - 64,000	---	Some insoluble species; sorption, metabolism, bioaccumulation important
Nickel	58.71	40 - 100	0.8 - 192	---	Soluble species exist; some bioaccumulation, sorption
Vanadium	50.942	---	---	---	---
Zinc	65.38	1,000 - 40,000	51 - 1,130	0.1 - 8,000	Sorption, bioaccumulation important

K_d = Distribution coefficient
 MOL WT = Molecular weight
 BCF = Bioconcentration or bioaccumulation factor; freshwater species

(1) Weast, 1988

(2) Versar, 1979

(3) EPA, August 19, 1983a; EPA, August 19, 1983b; EPA, August 19, 1983c; EPA, February 18, 1986; EPA, August 19, 1983d; EPA, April 10, 1986; EPA, August 19, 1983e; EPA, October 1980a; EPA October 1980b

2.3.1.2 Vapor Pressure

Vapor pressure provides an indication of the rate at which a chemical volatilizes from both soil and water. It is of primary significance at environmental interfaces, such as surface soil/air and surface water/air. Volatilization is not as important when evaluating contaminated groundwater and subsurface soils. Of the commonly detected site contaminants, vapor pressure for compounds such as acetone and benzene are generally higher than vapor pressure for polycyclic aromatic hydrocarbons (PAHs) and phthalates. Chemicals with higher vapor pressure are expected to enter the atmosphere much more readily than chemicals with lower vapor pressure. Volatilization can be a significant loss process for volatile organics in surface media. At the Allied Fibers Frankford facility, approximately 60 to 70 percent of soils are covered by asphalt, cement, or buildings, which severely limits the potentiality for volatilization (see Section 3.4). Most of the remainder of the site is overlain by gravel.

2.3.1.3 Solubility

The rate at which a chemical is leached from a waste deposit by infiltrating precipitation is contingent upon its water solubility. More soluble chemicals are more readily leached than less soluble chemicals. The water solubilities presented in Table 2-1 indicate that the volatile organic compounds are several orders of magnitude more water soluble than the PAHs and phthalates detected at the site. Cumene is intermediate in solubility between volatile organic compounds (VOCs) and PAHs. Naphthalene and 2-methylnaphthalene are the most soluble of the PAHs, but their solubility still does not approach that of compounds such as acetone and phenol. Solubility can also affect the sinking and floating behavior of chemicals. For example, cumene will float when present in concentrations exceeding its solubility.

2.3.1.4 Octanol/Water Partition Coefficient (K_{OW})

The K_{OW} is a measure of the equilibrium partitioning of chemicals between octanol and water. A linear relationship between the K_{OW} and the uptake of chemicals by fatty tissues of aquatic organisms [the bioconcentration factor (BCF)] has been determined. In fact, some BCFs presented in Table 2-1 are derived from the K_{OW} where experimental data were not available. The log K_{OW} (the form in which this property is typically reported) is provided for organic chemicals on Table 2-1. It can be seen that PAHs tend to partition to the non-aqueous phase much more readily than compounds such as acetone and pyridine.

2.3.1.5 Bioconcentration Factor (BCF)

Bioconcentration factors (BCFs) represent the ratio of aquatic animal tissue concentration to water concentration. The ratio is both contaminant- and species-specific. When site-specific values are not measured, literature values may be used, or the BCF may be derived from the K_{OW} . It can be seen from the values in Tables 2-1 and 2-2 that the VOCs and phenols are not as likely to bioconcentrate as chemicals such as PAHs. It should be noted that PAHs can be metabolized by vertebrates, and PAH bioconcentration is more likely for invertebrates (Versar, 1979).

2.3.1.6 Henry's Law Constant

Both the vapor pressure and the water solubility are of use in determining volatilization rates from surface water bodies and from groundwater. The ratio of these two parameters, the Henry's Law constant, is used to calculate the equilibrium contaminant concentrations in the vapor versus the liquid phases for the dilute solutions commonly encountered in environmental settings. In general, chemicals having a Henry's Law Constant of less than 5×10^{-6} atm-m³/mol such as benzo[a]pyrene should volatilize very little and be present only in minute amounts in the atmosphere or in soil gas. For chemicals with a Henry's Law Constant greater than 5×10^{-3} atm-m³/mol such as cumene and benzene, volatilization and diffusion in soil gas could be significant.

2.3.1.7 Organic Carbon Partition Coefficient (K_{OC})

The K_{OC} indicates the tendency of a chemical to bind to the organic carbon present in soil or sediment. Chemicals with high K_{OC} values generally have low water solubilities and vice versa. This parameter may be used to infer the relative rates at which the more mobile chemicals (benzene, phenol, styrene) are transported in the groundwater. Chemicals such as PAHs and phthalates are relatively immobile in the environment and are preferentially bound to the soil phase. These compounds are not subject to groundwater transport to the extent that compounds with higher water solubilities are. K_{OC} s are given in Table 2-1.

2.3.1.8 Distribution Coefficient (K_d)

The K_d is a measure of the equilibrium distribution of a chemical or ion in soil/water systems. The distribution of organic chemicals is a function of both the K_{OC} and the amount of organic carbon in the soil. For ions (e.g., metals), K_d is the ratio of the concentration adsorbed on soil surfaces to the concentration in water. K_d s for metals vary over several orders of magnitude because the K_d is dependent on the size and charge of the ion and the soil properties governing exchange sites on soil surfaces. Coulomb's Law predicts that the ion with the smallest hydrated radius and the largest charge will be preferentially accumulated over ions with larger radii and smaller charges. K_d s for several metals are shown in Table 2-2.

2.3.2 Contaminant Persistence

The persistence of various classes of site contaminants is discussed in this section. Several transformation mechanisms can affect contaminant persistence in the environment, such as hydrolysis, biodegradation, photolysis, and oxidation/reduction reactions.

In general, photolytic degradation is not considered to be a relevant degradation mechanism for compounds at this facility; virtually all of the contamination is located in the subsurface soil and groundwater.

Generally, organic molecules are subject to several chemical reactions under environmental conditions. Such reaction mechanisms include acid/base reactions, addition, elimination, and hydrolysis. However, monocyclic aromatics and chlorinated alkanes and alkenes are not particularly amenable to the majority of these degradation mechanisms. As can be seen in Table 2-3, hydrolysis is also considered to be negligible for PAHs. Alkyl halides and phthalates can be more susceptible (Versar, 1979; EPA, December 1982).

Hydrolysis can occur under acidic, basic, or neutral conditions. Because the groundwater pH is generally neutral (5.9 to 8.25), neutral hydrolysis for certain compounds could occur under the appropriate conditions.

TABLE 2-3
PERSISTENCE-RELATED PROPERTIES OF SELECTED ORGANIC CHEMICALS
ALLIED FIBERS FRANKFORD PLANT
PHILADELPHIA, PENNSYLVANIA

CHEMICAL	HYDROLYSIS RATE CONSTANTS ⁽¹⁾				BIODEGRADATION ⁽²⁾
	K _{acid} (m ⁻¹ hr ⁻¹)	K _{base} (m ⁻¹ hr ⁻¹)	K _{neutral} (hr ⁻¹)	Ref. Temp. (C)	
Methylene Chloride	0		1.15E-7	25	100% 7d (scf, sdw)
Benzene	0	0	0	---	68/110-day T1/2 (sgw, fo); 100% 434d (sgw, fo)
Toluene	0	0	0	---	37-39d T1/2, 100% 80d (sgw, fo)
Ethylbenzene	0	0	0	---	37d T1/2 (sgw, fo)
Xylenes	NR	NR	NR	---	11-37d T1/2 (sgw, fo)
Styrene	NR	NR	NR	---	2.3-12% per w (si, nmf)
2-Methylphenol	NR	NR	NR	---	Total methylphenols: 4-d T1/2 (sgw, fo)
4-Methylphenol	NR	NR	NR	---	(see above)
2,4-Dimethylphenol	0	0	0	---	100% 7d (scf, sdw)
Pyridine	NR	NR	NR	---	100% 8d (si, nmf)
1,2-Dichloroethane	0		1.8E-9	25	23% 7d (scf, sdw)
Trans-1,2-Dichloroethene	0	0	0	---	100% 50hr (swi, nmm; 139-d T1/2 (swi, nmf)
Trichloroethene	0	0	0	---	300d T1/2 (sgw, fo)
Tetrachloroethene	0	0	0	---	300d T1/2 (sgw, fo)
Isophorone	0	0	0	---	100% 7d (scf, sdw)
Biphenyl	NR	NR	NR	---	37d T1/2 (sgw, fo)
Acetophenone	NR	NR	NR	---	4d T1/2 (sgw, fo)
Phenol	0	0	0	---	97% 7d (scf, sdw)
Chlorobenzene	0	0	0	---	37d T1/2 (sgw, fo)
Cumene	NR	NR	NR	---	100% 11d (bgw, nmf); 100% 192 hrs (sp, nmf)
alpha-Methylstyrene	NR	NR	NR	---	
Acenaphthylene	0	0	0	---	96% 7d (scf, sdw)

TABLE 2-3
PERSISTENCE-RELATED PROPERTIES OF SELECTED ORGANIC CHEMICALS
ALLIED FIBERS FRANKFORD PLANT
PAGE TWO OF THREE

CHEMICAL	HYDROLYSIS RATE CONSTANTS(1)				BIODEGRADATION(2)
	K _{acid} (m ⁻¹ hr ⁻¹)	K _{base} (m ⁻¹ hr ⁻¹)	K _{neutral} (hr ⁻¹)	Ref. Temp. (C)	
Acenaphthene	0	0	0	---	98% 7d (scf, sdw)
Dibenzofuran	NR	NR	NR	---	100% 1w (si, naf)
Fluorene	0	0	0	---	74% 7d (scf, sdw)
Phenanthrene	0	0	0	---	100% 7d (scf, sdw)
Anthracene	0	0	0	---	35% 7d (scf, sdw)
Fluoranthene	0	0	0	---	0% 7d (scf, sdw)
Pyrene	0	0	0	---	41% 7d (scf, sdw)
Naphthalene	0	0	0	---	100% 7d (scf, sdw); 110d T1/2 (si, nmf)
2-Methylnaphthalene	NR	NR	NR	---	100% 9d (bgw, nmf); 100% 1w (si, naf)
Benz(a)anthracene	0	0	0	---	8% 7d (scf, sdw)
Chrysene	0	0	0	---	3% 7d (scf, sdw)
Benzo(b)fluoranthene	0	0	0	---	360 - 610d T1/2 (si, nmf)
Benzo(k)fluoranthene	0	0	0	---	910-1,400d T1/2 (si, nmf)
Benzo(a)pyrene	0	0	0	---	28% 16 mo (si, nmf)
Indeno(1,2,3-c,d)pyrene	0	0	0	---	600 - 730d T1/2 (si, nmf)
Dibenz(a,h)anthracene	0	0	0	---	750 - 940d T1/2 (si, nmf)
Benzo(g,h,i)perylene	0	0	0	---	590 - 650d T1/2 (si, nmf)
Di-n-butyl Phthalate	7.92E-3	79.2	0	30	100% 7d (scf, sdw)
Bis(2-ethylhexyl) Phthalate	4E-5	0.4	0	30	0% 7d (scf, sdw)
Di-n-octyl Phthalate	7.92E-3	79.2	0	30	0% 7d (scf, sdw)

TABLE 2-3
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References

- (1) EPA, December 1982
(2) Dragun, 1988

NR = Not reported; chemicals of this type are generally resistant to hydrolysis.
d = day(s)
scf = static-culture flask
sdw = settled domestic wastewater as inoculum
sgw = naturally occurring soil-groundwater system
fo = field observation
T1/2 = half-life
swi = soil-water incubation study
w = week(s)
si = soil incubation
nmf = natural microbial flora as inoculum
hr = hour
nmm = natural microbial flora; methanogenic conditions
bgw = batch test using groundwater
sp = soil percolation study
naf = natural acclimated microbial flora

Biodegradation is a potential environmental fate mechanism for most of the prominent plant contaminants (benzene, phenol, cumene, cresols, pyridine, and PAHs). Reported experimental values for biodegradation are shown in Table 2-3, where available. Preferentially, results obtained from a soil-groundwater system field observation were used. It can be seen that 2,4-dimethylphenol, cumene, phenol, and naphthalene are generally expected to have low persistence in the environment, as opposed to compounds such as bis(2-ethylhexyl) phthalate (DEHP) and benzo(a)pyrene. The degree that biodegradation is occurring at the facility was not directly assessed during the Phase I RFI.

2.4 HEALTH AND ENVIRONMENTAL ASSESSMENT

The current RFI guidance recommends the preparation of a Health and Environmental Assessment (HEA) (EPA, May 1989). The HEA may be based on a set of criteria (concentrations or "action levels") to which the measured contaminant concentrations are compared. When an action level is exceeded, closer evaluation is suggested. If site-specific concentrations are below the action levels, no further action may be required, primarily because of the conservative assumptions typically used in the action level development process. However, even if an action level has been exceeded, proposed regulations allow the owner to demonstrate that no action is required based on site-specific characteristics and land use (EPA, July 27, 1990). At this site, the action levels will be addressed by site-specific clean-up levels.

2.4.1 Exposure Routes

At the Allied Fibers Frankford facility, contaminated media include subsurface soil and groundwater. The potential release mechanisms and migration pathways that may be involved include release of soil contaminants to groundwater, discharge of groundwater contaminants to the surface water, migration of groundwater contaminants to the deeper sand/gravel units, and infiltration of contaminants into sewers. The potential exposure routes include incidental ingestion and dermal absorption from direct contact with subsurface soil (employees during excavation), inhalation of vapors and particulates during soil excavation, consumption of groundwater, inhalation and dermal exposure from use of groundwater, direct contact with surface water, fish consumption, and inhalation of vapors after sewer infiltration.

2.4.1.1 Soil Pathways

Because the facility is an active chemical plant with restricted access, exposure of off-site residents, including children, to soil is not anticipated. There are no plans for any other future land uses. If Allied were to sell the property, restrictions on future land use would likely have to be recorded in the deed.

Because of the existing soil cover, exposure to Allied workers (and off-site residents) is not expected during typical on-the-job activities. During excavation operations, worker (and off-site resident) exposure is expected to be mitigated by good health and safety practices, as described in Section 5.6.

Thus, there is no threat posed by the direct contact pathway at the Allied facility, as long as good health and safety practices are followed.

At this time, specific hydrogeologic parameters necessary to assess potential groundwater contamination [groundwater flow directions(s), velocity, etc.] resulting from vadose zone soil contamination have not been defined. Therefore, part of the Phase II investigation should involve determination of those parameters. If the soil leaching pathway at certain SWMUs is found not to pose a threat to human health and the environment in the Phase II HEA, these SWMUs should be eliminated from further consideration, subject to EPA approval.

2.4.1.2 Groundwater Pathways

There are no known users of shallow groundwater. As discussed in more detail in Section 4.6, the primary potential pathways of concern for shallow groundwater are infiltration into the deeper aquifer and release to surface water. There are no known users of the deeper aquifer on the Philadelphia side of the Delaware River. (Discharge of the deeper aquifer to the Delaware River is suspected.) It has not been determined at this time if any of these potential pathways are complete (i.e., actually exist) and, if so, what factors (e.g., infiltration rate, flow velocity) govern them.

Infiltration of groundwater into one or more of the sewer lines crossing the plant is likely. Secondary exposure to vapors associated with sewer infiltration is a possibility. This pathway also has not been characterized to date.

These pathways are expected to be defined in Phase II. If one or more of these pathways are found to be complete, they will be used to establish site-specific clean-up levels for groundwater.

2.4.2 Criteria/Guidelines

Screening RCRA sites using appropriate criteria is usually recommended for RFIs (EPA, May 1989). However, the recommended screening criteria exist for only two pathways: direct contact (soil) and potable use (groundwater) (EPA, July 27, 1990). Neither pathway actually exists at this site.

Because the potential pathways cannot be quantitatively defined at this time, screening criteria and risk calculations were not performed. Site-specific clean-up levels will be calculated in Phase II as described below. SWMUs that do not exceed site-specific clean-up levels will be eliminated from further risk assessment.

To assess human health or environmental risks, three major aspects of chemical contamination and environmental fate and transport must be considered: contaminants with toxic characteristics must be found in environmental media and be released by either natural process or human action; pathways by which actual or potential exposure occurs must be present; and human or environmental receptors must be present to complete the exposure route. Risk is a function of both toxicity and exposure; without one of the factors listed above, there will be no risk.

Many of the theoretical exposure routes that could exist at this facility are actually incomplete (either the pathways are incomplete or there are no receptors). As discussed in Section 2.4.1, the realistic potential release mechanisms and migration pathways are the following: release of soil contaminants to groundwater, discharge of groundwater contaminants to the deeper sand/gravel unit, discharge of groundwater contaminants to surface water, and infiltration of groundwater contaminants into the city sewer system. Exposure routes associated with these pathways could include recreational exposure to surface water discharge points, fish ingestion, etc. (The actual uses of surface water are discussed in Section 3.3.) Phase II will provide information to establish which of these routes actually exist.

Because there are no known consumers of shallow (and deep) groundwater (this will be verified during Phase II of the RFI), risks via domestic use of groundwater are not anticipated and will not be quantitated. Contaminant release to surface water bodies such as the Frankford Inlet or the Delaware River, if any; and infiltration into sewer lines, if any, will be considered. Development of site-specific clean-up levels is considered appropriate to address these potential pathways rather than direct consumption of groundwater. This approach would involve establishing Maximum Allowable Exposure Concentrations (MAECs) at the potential points of exposure and use of contaminant fate and transport modeling to determine clean-up levels at the property line. MAECs would be derived using conservative assumptions regarding the potential exposures listed above, if applicable.

2.4.3 Potentially Applicable Requirements

This section presents available regulatory standards or guidelines and dose-response parameters for potential chemicals of concern at the Allied Fibers Frankford facility. The standards will be used to set MAECs at the points of exposure if complete exposure pathways are identified as a result of the Phase II RFI, from which site-specific clean-up levels would eventually be derived.

Drinking water standards/guidelines, including Maximum Contaminant Levels (MCLs), Maximum Contaminant Level Goals (MCLGs), and Health Advisories (HAs) are shown along with Risk Reference Doses (RfDs) and Cancer Slope Factors (CSFs) in Table 2-4. Drinking water standards are not expected to be applicable, as discussed in Section 2.4.1. However, the New Jersey surface water criteria refer to MCLs, and potential uses of the deep aquifer have not been completely defined at this point. Therefore, drinking water standards are presented, although they may not be applicable.

MCLs are enforceable standards promulgated under the Safe Drinking Water Act and are designed for the protection of human health, but they also reflect the technical feasibility of removing the contaminant from the water. MCLGs are specified as zero for carcinogenic chemicals, based on the assumption of nonthreshold toxicity, and do not consider either the technical or economic feasibility of achieving these goals. Non-zero MCLGs below MCLs are nonenforceable guidelines based entirely on health effects. MCLs are set as close to MCLGs as technically feasible. HAs are guidelines developed by the EPA Office of Drinking Water for certain nonregulated contaminants in drinking water. These guidelines are designed to consider both acute and chronic toxic effects based on specific receptors (e.g., 10-kilogram child) for a specific exposure scenario (e.g., 10-day exposure to one liter per day). HAs are designed to consider only threshold effects.

Aquatic standards, including federal and state criteria for the pertinent reach of the Delaware River and tidal tributaries, are shown in Table 2-5. Ambient Water Quality Criteria (AWQCs) are not enforceable federal regulatory guidelines and are of primary utility in assessing the potential for toxic effects in aquatic organisms. They may also be used to identify the potential for human health risks.

AWQCs consider the acute and chronic toxic effects in both freshwater and saltwater aquatic life, and the adverse human health effects from ingestion of both water (two liters per day) and aquatic organisms (6.5 grams per day) and from ingestion of organisms alone. These standards would be used to set MAECs if surface water exposure routes are identified as a result of the Phase II RFI.

Chronic inhalation Reference Doses (RfDs) and CSFs are shown in Table 2-6. These guidelines would be used to set MAECs if vapor exposure pathways are identified as a result of the Phase II RFI. PAHs and phthalates, for which volatilization is negligible, were not included on Table 2-6.

TABLE 2-4
POTENTIALLY APPLICABLE DRINKING WATER CRITERIA AND DOSE-RESPONSE PARAMETERS
ALLIED FIBERS FRANKFORD PLANT
PHILADELPHIA, PENNSYLVANIA

Chemical	Effective or Final MCL (ug/l)(1)(2)(3)(4)(5)(6)	Tentative(7) or Proposed MCL (ug/l)	MCLG(7) (ug/l)	RfD(8) (oral) (mg/kg/day)	CSF(8) (oral) (mg/kg/day) ⁻¹	Health Advisories(7) (ug/l)
Acetone	---	---	---	1E-1	---	---
Benzene	5	---	0	---	A: 2.9E-2	One-day child: 200; ten-day child: 200
Chlorobenzene	100	---	100	2E-2	---	One-day child: 2,000; ten-day child: 2,000; longer-term child: 2,000 Longer-term adult: 7,000; lifetime adult: 100
Carbon disulfide	---	---	---	1E-1	---	---
1,1-Dichloroethane	---	---	---	1E-1	C	---
Trans-1,2-Dichloroethene	100	---	100	2E-2	---	One-day child: 20,000; ten-day child: 2,000; longer-term child: 2,000 Longer-term adult: 6,000; lifetime adult: 100
Ethylbenzene	700	---	700	1E-1	---	One-day child: 30,000; ten-day child: 3,000; longer-term child: 1,000 Longer-term adult: 3,000; lifetime adult: 700
2-Butanone	---	---	---	5E-2	---	One-day child: 80,000; ten-day child: 8,000; longer-term child: 3,000 Longer-term adult: 9,000; lifetime adult: 200
4-Methyl-2-Pentanone	---	---	---	5E-2	---	---
Styrene	100	---	100	2E-1	B2: 3E-2	One-day child: 20,000; ten-day child: 2,000; longer-term child: 2,000 Longer-term adult: 7,000; lifetime adult: 100
Tetrachloroethene	5	---	0	1E-2	B2: 5.1E-2	One-day child: 2,000; ten-day child: 2,000; longer-term child: 1,000 Longer-term adult: 5,000

TABLE 2-4
 POTENTIALLY APPLICABLE DRINKING WATER CRITERIA AND DOSE-RESPONSE PARAMETERS
 ALLIED FIBERS FRANKFORD PLANT
 PAGE TWO OF FIVE

Chemical	Effective or Final MCL (ug/l)(1)(2)(3)(4)(5)(6)	Tentative(7) or Proposed MCL (ug/l)	MCLG(7) (ug/l)	RfD(8) (oral) (mg/kg/day)	CSF(8) (oral) (mg/kg/day)-1	Health Advisories(7) (ug/l)
Toluene	1,000	---	1,000	2E-1	---	One-day child: 20,000; ten-day child: 2,000; longer-term child: 2,000 Longer-term adult: 7,000; lifetime adult: 1,000
1,1,1-Trichloroethane	200	---	200	9E-2	---	One-day child: 100,000; ten-day child: 40,000; longer-term child: 40,000 Longer-term adult: 100,000; lifetime adult: 200
Trichloroethene	5	---	0	---	B2: 1.1E-2	---
Xylenes	10,000	---	10,000	2	---	One-day child: 40,000; ten-day child: 40,000; longer-term child: 40,000 Longer-term adult: 100,000; lifetime adult: 10,000
Acenaphthene	---	---	---	6E-2	---	---
Acenaphthylene	---	---	---	---	---	---
Acetophenone	---	---	---	1E-1	---	---
Aniline	---	---	---	---	---	---
Anthracene	---	---	---	3E-1	---	---
Benz(a)anthracene	---	0.1	0	---	B2	---
Benzo(b)fluoranthene	---	0.2	0	---	B2	---
Benzo(k)fluoranthene	---	0.2	0	---	B2	---
Benzo(g,h,i)perylene	---	---	---	---	---	---
Benzo(a)pyrene	---	0.2	0	---	B2: 5.8	---
Bis(2-ethylhexyl) Phthalate	---	4	0	2E-2	B2: 1.4E-2	---

TABLE 2-4
POTENTIALLY APPLICABLE DRINKING WATER CRITERIA AND DOSE-RESPONSE PARAMETERS
ALLIED FIBERS FRANKFORD PLANT
PAGE THREE OF FIVE

Chemical	Effective or Final MCL (ug/l)(1)(2)(3)(4)(5)(6)	Tentative(7) or Proposed MCL (ug/l)	MCLG(7) (ug/l)	RfD(8) (oral) (mg/kg/day)	CSF(8) (oral) (mg/kg/day) ⁻¹	Health Advisories(7) (ug/l)
Chrysene	---	0.2	0	---	B2	---
Dibenz(a,h)anthracene	---	0.3	0	---	B2	---
Dibenzofuran	---	---	---	---	---	---
Di-n-butyl Phthalate	---	---	---	1E-1	---	---
Diethyl Phthalate	---	---	---	8E-1	---	Lifetime adult: 5,000
Di-n-octyl Phthalate	---	---	---	2E-2	---	---
Fluoranthene	---	---	---	4E-2	---	---
Fluorene	---	---	---	4E-2	---	---
Indeno(1,2,3-c,d)pyrene	---	0.4	0	---	B2	---
Isophorone	---	---	---	2E-1	C: 4.1E-3	One-day child: 15,000; ten-day child: 15,000; longer-term child: 15,000 Longer-term adult: 15,000; lifetime adult: 100
2-Methylnaphthalene	---	---	---	---	---	---
Naphthalene	---	---	---	4E-3	---	One-day child: 500; ten-day child: 500; longer-term child: 400 Longer-term adult: 1,000; lifetime adult: 20
alpha-Naphthylamine	---	---	---	---	---	---
beta-Naphthylamine	---	---	---	---	---	---
N-Nitrosodiphenylamine	---	---	---	---	B2: 4.9E-3	---
Phenanthrene	---	---	---	---	---	---

TABLE 2-4
POTENTIALLY APPLICABLE DRINKING WATER CRITERIA AND DOSE-RESPONSE PARAMETERS
ALLIED FIBERS FRANKFORD PLANT
PAGE FOUR OF FIVE

Chemical	Effective or Final MCL (ug/l) ⁽¹⁾⁽²⁾ (3)(4)(5)(6)	Tentative ⁽⁷⁾ or Proposed MCL (ug/l)	MCLG ⁽⁷⁾ (ug/l)	RfD ⁽⁸⁾ (oral) (mg/kg/day)	CSF ⁽⁸⁾ (oral) (mg/kg/day) ⁻¹	Health Advisories ⁽⁷⁾ (ug/l)
Pyrene	---	---	---	3E-2	---	---
Pyridine	---	---	---	1E-3	---	---
2-Methylphenol	---	---	---	5E-2	C	---
4-Methylphenol	---	---	---	5E-2	C	---
2,4-Dimethylphenol	---	---	---	2E-2	---	---
Phenol	---	---	---	6E-1	---	---
2,4,5-T	---	---	---	1E-2	---	One-day child: 800; ten-day child: 800; longer-term child: 800 Longer-term adult: 1,000; lifetime adult: 70
Arsenic	50	---	0	1E-3	A: 5E-5 per ug/l	---
Barium	2,000(F); 1,000(N)	---	2,000	5E-2	---	Lifetime adult: 2,000
Beryllium	---	1	0	5E-3	B2: 4.3	One-day child: 30,000; ten-day child: 30,000; longer-term child: 4,000 Longer-term adult: 20,000
Chromium	100(F); 50(N)	---	100	III: 1 VI: 5E-3	---	One-day child: 1,000; ten-day child: 1,000; longer-term child: 200 Longer-term adult: 800; lifetime adult: 200
Cobalt	---	---	---	---	---	---
Copper	1,300(A)	---	---	1,300 ug/l	---	---

TABLE 2-4
POTENTIALLY APPLICABLE DRINKING WATER CRITERIA AND DOSE-RESPONSE PARAMETERS
ALLIED FIBERS FRANKFORD PLANT
PAGE FIVE OF FIVE

Chemical	Effective or Final MCL (ug/l) ⁽¹⁾⁽²⁾ (3)(4)(5)(6)	Tentative ⁽⁷⁾ or Proposed MCL (ug/l)	MCLG ⁽⁷⁾ (ug/l)	RfD ⁽⁸⁾ (oral) (mg/kg/day)	CSF ⁽⁸⁾ (oral) (mg/kg/day) ⁻¹	Health Advisories ⁽⁷⁾ (ug/l)
Lead	50(N); 15(A)	---	0	---	B2	---
Mercury	2	---	2	3E-4	---	Longer-term adult: 2; lifetime adult: 2
Nickel	---	100	100	2E-2	---	One-day child: 1,000; ten-day child: 1,000; longer-term child: 100 Longer-term adult: 600; lifetime adult: 100
Silver	50	---	---	3E-3	---	One-day child: 200; ten-day child: 200; longer-term child: 200 Longer-term adult: 200; lifetime adult: 100
Vanadium	---	---	---	7E-3	---	One-day child: 80; ten-day child: 80; longer-term child: 30 Longer-term adult: 110; lifetime adult: 20
Zinc	---	---	---	2E-1	---	One-day child: 4,000; ten-day child: 4,000; longer-term child: 2,000 Longer-term adult: 9,000; lifetime adult: 2,000
Cumene	---	---	---	4E-2	---	---
alpha-Methylstyrene	---	---	---	7E-2	---	---
Methylene Chloride	---	5	0	6E-2	B2: 7.5E-3	One-day child: 10,000; ten-day child: 2,000

A = Group A carcinogen
 B2 = Group B2 carcinogen
 C = Group C carcinogen
 MCL = Maximum Contaminant Level
 MCLG = Maximum Contaminant Level Goal
 RfD = Risk reference dose
 CSF = Cancer slope factor
 (F) = Final
 (N) = National Primary Drinking Water Regulation
 (A) = Action Level

(1) EPA, July 1991
 (2) EPA, January 30, 1991
 (3) EPA, July 25, 1990
 (4) EPA, July 1, 1991
 (5) EPA, June 7, 1991
 (6) EPA, July 18, 1991
 (7) EPA, April 1991
 (8) EPA, January 1991

**TABLE 2-5
SURFACE WATER CRITERIA
ALLIED FIBERS FRANKFORD PLANT
PHILADELPHIA, PENNSYLVANIA**

Parameters	New Jersey Criteria ⁽¹⁾ (ug/l)	Pennsylvania Criteria ⁽²⁾ (ug/l)	Ambient Water Quality Criteria			
			Acute, Freshwater ⁽³⁾⁽⁴⁾⁽⁵⁾ (ug/l)	Chronic, Freshwater ⁽³⁾⁽⁴⁾⁽⁵⁾ (ug/l)	For Protection of Water Consumption and Fish Ingestion ⁽³⁾	For Protection of Fish Ingestion Only ⁽³⁾
Phenols	0.005 mg/l (maximum unless exceeded due to natural conditions)	2,000 (4-MP; H)	---	---	---	---
Phenolics (except priority pollutants)	---	0.005 mg/l (maximum); 0.02 mg/l (4-day average); 0.1 mg/l (1-hour average)	---	---	---	---
Phenol	---	300 (H)	10,200 (LOEL)	2,560 (LOEL)	3.5 mg/l	---
2,4-Dimethylphenol	---	400 (H)	2,120 (LOEL)	---	---	---
Aluminum	---	Maximum 0.01 of the 96-hour LC50 for representative important species as determined through available literature or bioassay tests tailored to ambient quality of the receiving waters	---	87	---	---

TABLE 2-5
SURFACE WATER CRITERIA
ALLIED FIBERS FRANKFORD PLANT
PAGE TWO OF SIX

Parameters	New Jersey Criteria ⁽¹⁾ (ug/l)	Pennsylvania Criteria ⁽²⁾ (ug/l)	Ambient Water Quality Criteria			
			Acute, Freshwater ⁽³⁾⁽⁴⁾⁽⁵⁾ (ug/l)	Chronic, Freshwater ⁽³⁾⁽⁴⁾⁽⁵⁾ (ug/l)	For Protection of Water Consumption and Fish Ingestion ⁽³⁾	For Protection of Fish Ingestion Only ⁽³⁾
Iron	---	1.5 mg/l (daily average as total iron); 0.3 mg/l (maximum dissolved iron)	---	1,000	0.3 mg/l	---
Manganese	---	1.0 mg/l (maximum)	---	---	50 ug/l	100 ug/l
Nitrite plus Nitrate	---	10 mg/l (maximum as nitrogen)	---	---	10 mg/l (nitrates)	---
Arsenic	---	50 (H)	Tri: 360 Pent: 850	190 48	---	---
Chromium	---	Total: 170,050 (H) Hex: 50 (H)	Tri: 1,700 (aa) Hex: 16	210 (aa) 11	170 mg/l 50 ug/l	3,433 mg/l ---
Lead	---	50 (H)	82 (aa)	3.2 (aa)	50 ug/l	---
Mercury	---	0.144 (H)	2.4	0.012	144 ng/l	146 ng/l
Benzene	---	1 (H)	5,300 (LOEL)	---	0.66 ug/l (based on 10 ⁻⁶ cancer risk)	40 ug/l (based on 10 ⁻⁶ cancer risk)
Trans-1,2-Dichloroethene	---	350 (H)	11,600 (LOEL) (dichloroethenes)	---	0.033 ug/l (dichloroethenes: based on 10 ⁻⁶ cancer risk)	1.85 ug/l (dichloroethenes: based on 10 ⁻⁶ cancer risk)
1,2-Dichloroethane	---	0.4 (H)	118,000 (LOEL)	20,000 (LOEL)	0.94 ug/l (based on 10 ⁻⁶ cancer risk)	243 ug/l (based on 10 ⁻⁶ cancer risk)

TABLE 2-5
SURFACE WATER CRITERIA
ALLIED FIBERS FRANKFORD PLANT
PAGE THREE OF SIX

Parameters	New Jersey Criteria ⁽¹⁾ (ug/l)	Pennsylvania Criteria ⁽²⁾ (ug/l)	Ambient Water Quality Criteria			
			Acute, Freshwater ⁽³⁾⁽⁴⁾⁽⁵⁾ (ug/l)	Chronic, Freshwater ⁽³⁾⁽⁴⁾⁽⁵⁾ (ug/l)	For Protection of Water Consumption and Fish Ingestion ⁽³⁾	For Protection of Fish Ingestion Only ⁽³⁾
Toluene	---	14,300 (H)	17,500 (LOEL)	---	14.3 mg/l	424 mg/l
Ethylbenzene	---	1,400 (H)	32,000 (LOEL)	---	1.4 mg/l	3.28 mg/l
m-Xylene	---	300 (H)	---	---	---	---
o, p-Xylenes	---	300 (H)	Total xylenes: 10,000 (bb)	---	---	---
Tetrachloroethene	---	0.7 (H)	5,280 (LOEL)	840 (LOEL)	0.8 ug/l (based on 10 ⁻⁶ cancer risk)	9.85 ug/l (based on 10 ⁻⁶ cancer risk)
Bis(2-ethylhexyl) Phthalate	---	15,000 (H)	940 (LOEL; phthalates)	3 (LOEL; phthalates)	15 mg/l	50 mg/l
Styrene	---	---	---	---	---	---
Acetone	---	4,000 (H)	---	---	---	---
Chlorobenzene	---	20 (H)	250 (LOEL)	50 (LOEL)	468 ug/l	---
Carbondisulfide	---	---	---	---	---	---
1,1-Dichloroethane	---	---	118,000 (12 DCA LOEL)	20,000 (12 DCA, LOEL)	---	---
2-Butanone	---	2,000 (H)	---	---	---	---
4-Methyl-2-Pentanone	---	2,000 (H)	---	---	---	---
Styrene	---	---	---	---	---	---

TABLE 2-5
SURFACE WATER CRITERIA
ALLIED FIBERS FRANKFORD PLANT
PAGE FOUR OF SIX

Parameters	New Jersey Criteria ⁽¹⁾ (ug/l)	Pennsylvania Criteria ⁽²⁾ (ug/l)	Ambient Water Quality Criteria			
			Acute, Freshwater ⁽³⁾⁽⁴⁾⁽⁵⁾ (ug/l)	Chronic, Freshwater ⁽³⁾⁽⁴⁾⁽⁵⁾ (ug/l)	For Protection of Water Consumption and Fish Ingestion ⁽³⁾	For Protection of Fish Ingestion Only ⁽³⁾
1,1,1-Trichloroethane	---	1,000 (H)	18,000 (LOEL)	---	18.4 mg/l	1.03 g/l
Acenaphthene	---	20 (H)	1,700 (LOEL)	520 (LOEL)	---	---
Acenaphthylene	---	0.003 (H)	---	---	---	---
Acetophenone	---	---	---	---	---	---
Aniline	---	---	---	---	---	---
Anthracene	---	0.003 (H)	---	---	---	---
Benz(a)anthracene	---	0.003 (H)	---	---	---	---
Benzo(b)fluoranthene	---	---	---	---	---	---
Benzo(k)fluoranthene	---	0.003 (H)	---	---	---	---
Benzo(g,h,i)perylene	---	0.003 (H)	---	---	---	---
Benzo(a)pyrene	---	0.003 (H)	---	---	---	---
Chrysene	---	0.003 (H)	---	---	---	---
Dibenz(a,h)anthracene	---	0.003 (H)	---	---	---	---
Dibenzofuran	---	---	---	---	---	---
Di-n-butyl Phthalate	---	34,000 (H)	940 (tot, LOEL)	3 (tot, LOEL)	35 mg/l	154 mg/l
Diethyl Phthalate	---	350,000 (H)	940 (tot, LOEL)	3 (tot, LOEL)	350 mg/l	1.8 g/l
Di-n-octyl Phthalate	---	---	940 (tot, LOEL)	3 (tot, LOEL)	---	---

TABLE 2-5
SURFACE WATER CRITERIA
ALLIED FIBERS FRANKFORD PLANT
PAGE FIVE OF SIX

Parameters	New Jersey Criteria ⁽¹⁾ (ug/l)	Pennsylvania Criteria ⁽²⁾ (ug/l)	Ambient Water Quality Criteria			
			Acute, Freshwater ⁽³⁾⁽⁴⁾⁽⁵⁾ (ug/l)	Chronic, Freshwater ⁽³⁾⁽⁴⁾⁽⁵⁾ (ug/l)	For Protection of Water Consumption and Fish Ingestion ⁽³⁾	For Protection of Fish Ingestion Only ⁽³⁾
Fluoranthene	---	42 (H)	3,980 (LOEL)	---	42 ug/l	54 ug/l
Fluorene	---	0.003 (H)	---	---	---	---
Indeno(1,2,3-c,d)pyrene	---	0.003 (H)	---	---	---	---
Isophorone	---	5,200 (H)	117,000 (LOEL)	---	5.2 mg/l	520 mg/l
2-Methylnaphthalene	---	---	---	---	---	---
Naphthalene	---	10 (H)	2,300 (LOEL)	620 (LOEL)	---	---
alpha-Naphthylamine	---	---	---	---	---	---
beta-Naphthylamine	---	---	---	---	---	---
N-Nitrosodiphenylamine	---	5 (H)	---	---	4,900 ng/l	16,100 ng/l
Phenanthrene	---	0.003 (H)	---	---	---	---
Pyrene	---	0.003 (H)	---	---	---	---
Pyridine	---	---	---	---	---	---
2,4,5-T	---	---	---	---	---	---
Barium	---	1,000 (H)	---	---	1 mg/l	---
Beryllium	---	0.007 (H)	130 (LOEL)	5.3 (LOEL)	6.8 ng/l	117 ng/l
Cobalt	---	---	---	---	---	---
Copper	---	1,000 (H)	18 (aa)	12 (aa)	---	---

TABLE 2-5
SURFACE WATER CRITERIA
ALLIED FIBERS FRANKFORD PLANT
PAGE SIX OF SIX

Parameters	New Jersey Criteria ⁽¹⁾ (ug/l)	Pennsylvania Criteria ⁽²⁾ (ug/l)	Ambient Water Quality Criteria			
			Acute, Freshwater ⁽³⁾⁽⁴⁾⁽⁵⁾ (ug/l)	Chronic, Freshwater ⁽³⁾⁽⁴⁾⁽⁵⁾ (ug/l)	For Protection of Water Consumption and Fish Ingestion ⁽³⁾	For Protection of Fish Ingestion Only ⁽³⁾
Nickel	---	632 (H)	1,400 (aa)	160 (aa)	13.4 ug/l	100 ug/l
Silver	---	50 (H)	4.1 (aa)	0.12	50 ug/l	---
Vanadium	---	---	---	---	---	---
Zinc	---	5,000 (H)	120 (aa)	110 (aa)	---	---
Cumene	---	---	---	---	---	---
2-Methylstyrene	---	---	---	---	---	---
Methylene Chloride	---	5 (H)	---	---	---	---
Trichloroethene	---	3 (H)	45,000 (LOEL)	21,900 (LOEL)	2.7 ug/l	80.7 ug/l

4-MP = 4-Methylphenol
 Tri = Trivalent
 Hex = Hexavalent
 Pent = Pentavalent
 12DCA = 1,2-dichloroethane

tot = Total

ca = Cancer risk

LOEL = Lowest observed effect level

(aa) = Hardness dependent criterion (100 mg/l used)

H = Pennsylvania Human Health Criteria used to derive NPDES effluent limits

(1) New Jersey Department of Environmental Protection, 1989

(2) Pennsylvania Code Title 25, Chapter 93

(3) EPA, 1987

(4) EPA, 1988

(5) Federal Register, May 26, 1988

TABLE 2-6
INHALATION DOSE-RESPONSE PARAMETERS
ALLIED FIBERS FRANKFORD PLANT
PHILADELPHIA, PENNSYLVANIA

COMPOUND	RfD ⁽¹⁾ (mg/kg/day)	CSF ⁽¹⁾ (mg/kg/day) ⁻¹
Acetone	ND	---
Benzene	ND	A: 2.9E-2
Chlorobenzene	5E-3	---
Carbon disulfide	3E-3	---
1,1-Dichloroethane	1E-1	C
trans-1,2-Dichloroethene	ND	---
Ethylbenzene	3E-1	---
2-Butanone	9E-2	---
4-Methyl-2-pentanone	2E-2	---
Styrene	ND	B2: 2E-3
Tetrachloroethene	ND	B2: 1.8E-3
Toluene	6E-1	---
Trichloroethene	ND	B2: 1.7E-2
Xylenes	9E-2	---
Isophorone	ND	C
Pyridine	ND	---
2-Methylphenol	ND	---
4-Methylphenol	ND	---
2,4-Dimethylphenol	ND	---
Phenol	ND	---
2,4,5-T	ND	---
Cumene	3E-3	---
Alpha-Methylstyrene	ND	---
1,1,1-Trichloroethane	3E-1	---

RfD = Chronic inhalation Reference Dose

CSF = Inhalation cancer slope factor

ND = Not determined

A = Group A carcinogen

B2 = Group B2 carcinogen

C = Group C carcinogen

⁽¹⁾ EPA, January 1991